DTSA-II - QC

Nicholas W. M. Ritchie
Physicist, Microanalysis Research Group
National Institute of Standards and Technology
Gaithersburg, MD 20899-8371
nicholas.ritchie@nist.gov

Why?

- Is your instrument working correctly?
  - How can you demonstrate it?
- Was your instrument working correctly when a specific data set was collected?
  - How can you demonstrate it?
- Would you know if your instrument performance has degraded by 10%, 1%?
  - Are the standards you collected yesterday / a week ago / a year ago still good?

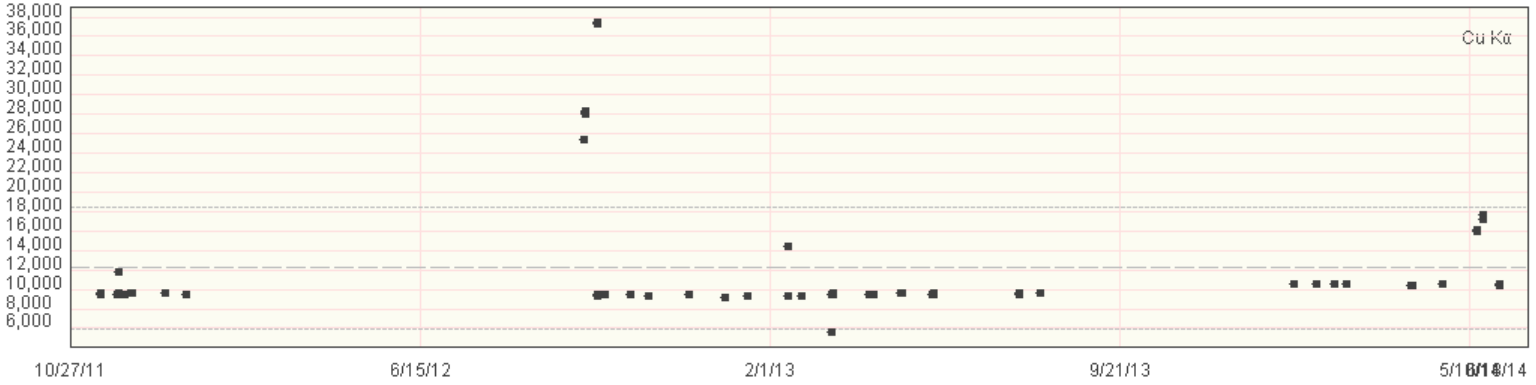
What could possibly go wrong?

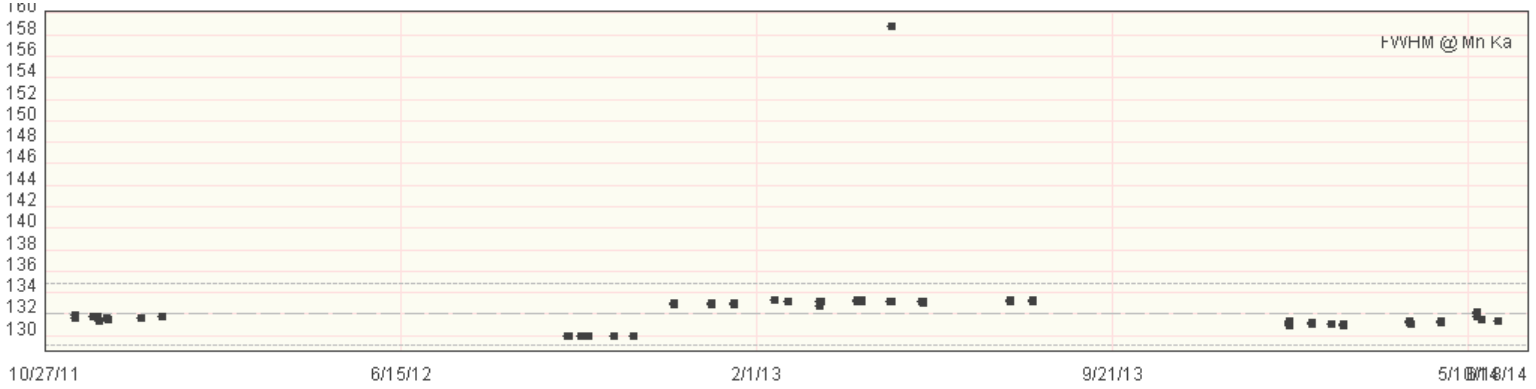
- Bad energy scale calibration
  - Gain or zero offset out of calibration
- Noise at low energy or wacky Bremsstrahlung
  - Electrical, light, acoustic noise, ground loops
- Change in detector efficiency
  - Window contamination, detector position, obstruction, icing
- Deterioration in resolution
  - Electrical, light, acoustic noise, misconfiguration, ground loops
- Floating ground
  - Stage not grounded

Strategy

- Collect a spectrum
  - from a established material
  - at a consistent beam energy, probe current, live time
  - with a consistent working distance, geometry.
- Extract numeric metrics
  - Resolution, calibration, intensity etc
- Track the metrics
  - Plot them on QC charts

Example control charts

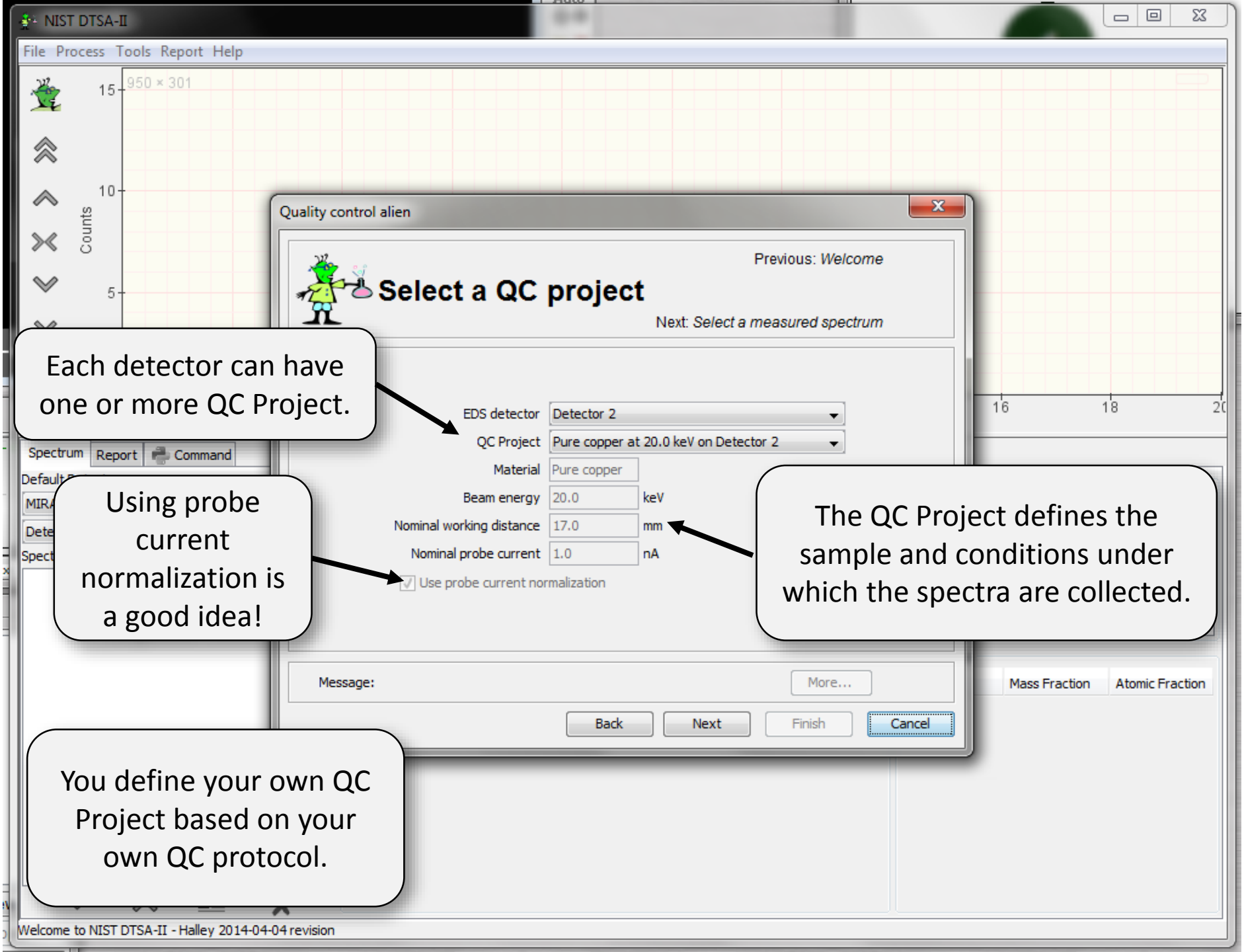


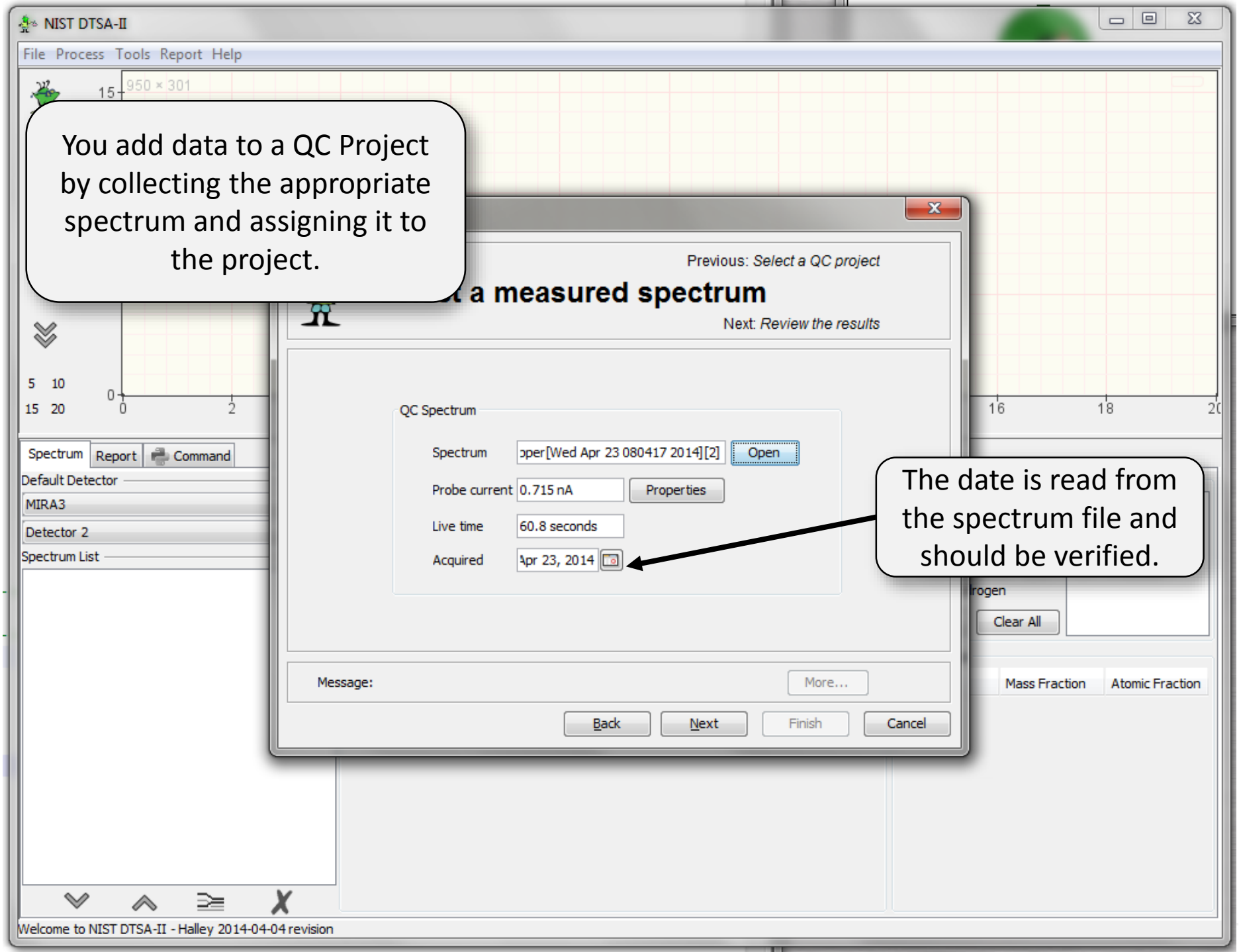


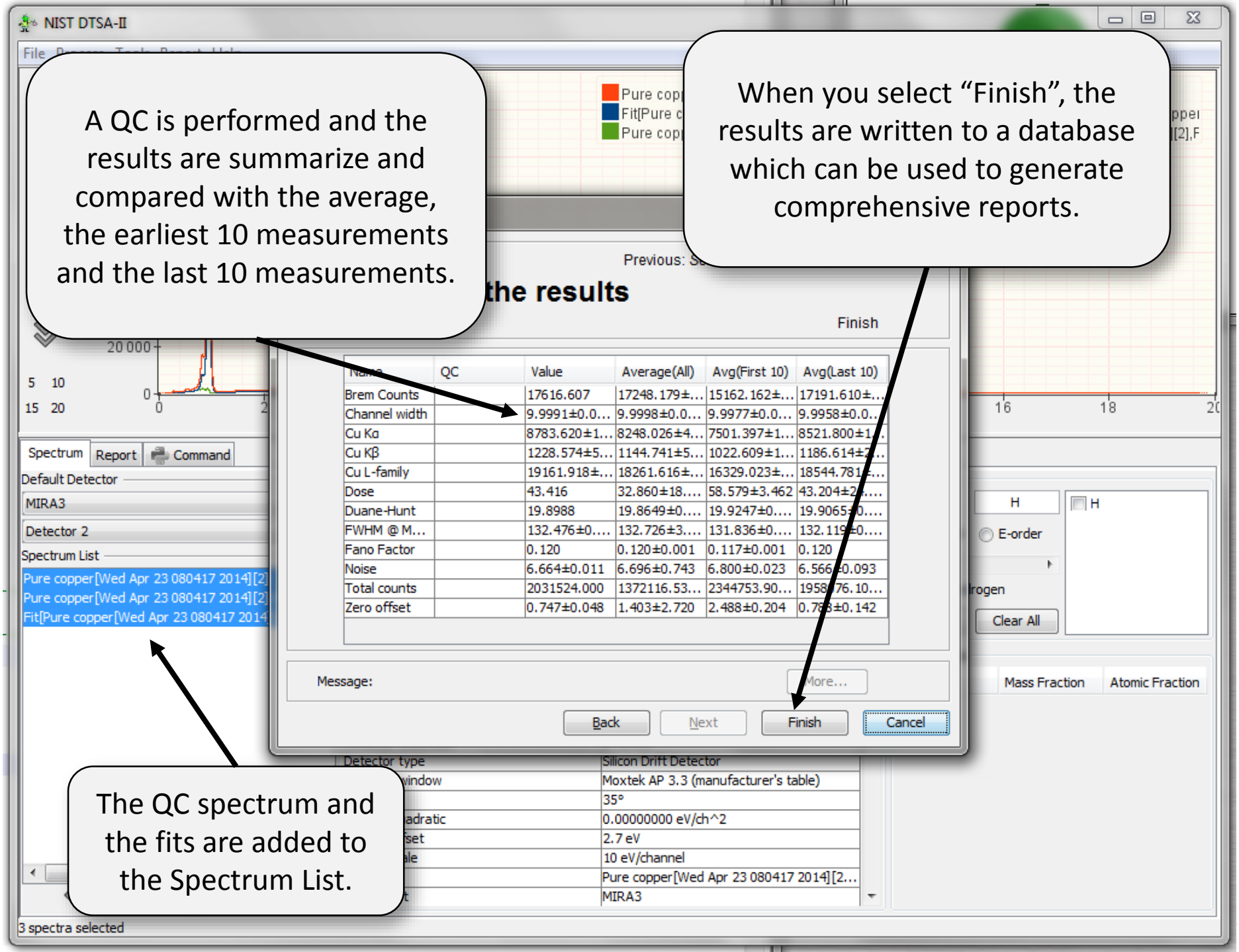
What does my QC look like?

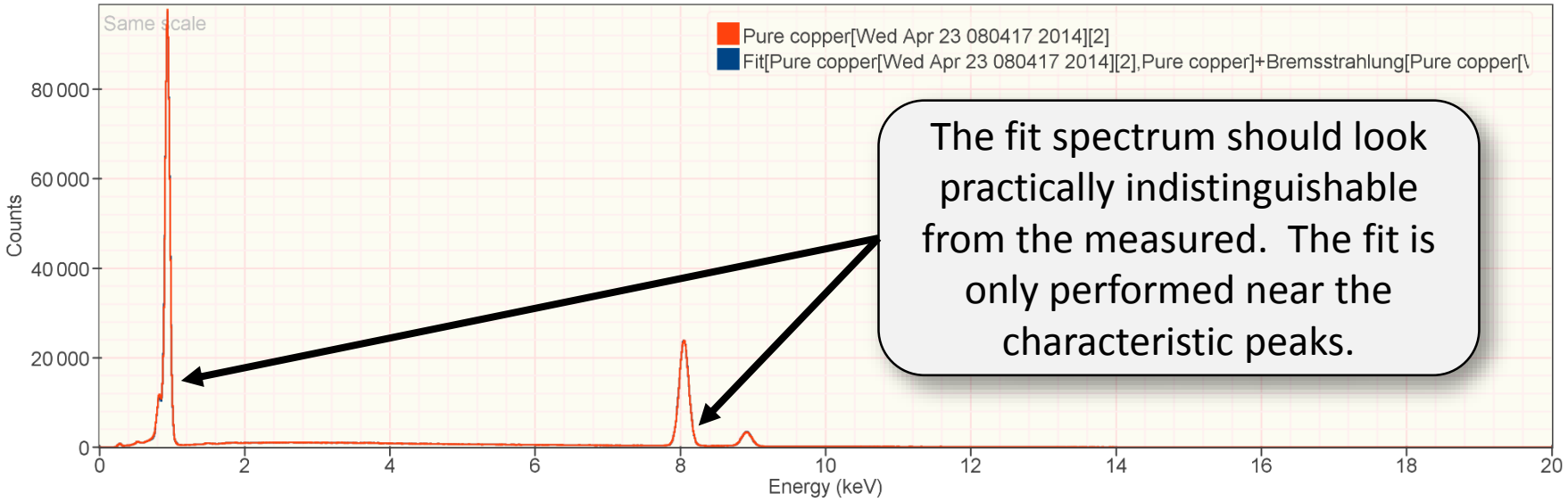
- Sample: Pure Cu
- Beam energy: 20 keV
- Probe current: 1 nA
- Live time: 60 s
- Working distance: 17 mm
- Processor setting: Medium

I collect a new QC every day I collect a new set of quantitative microanalysis data.

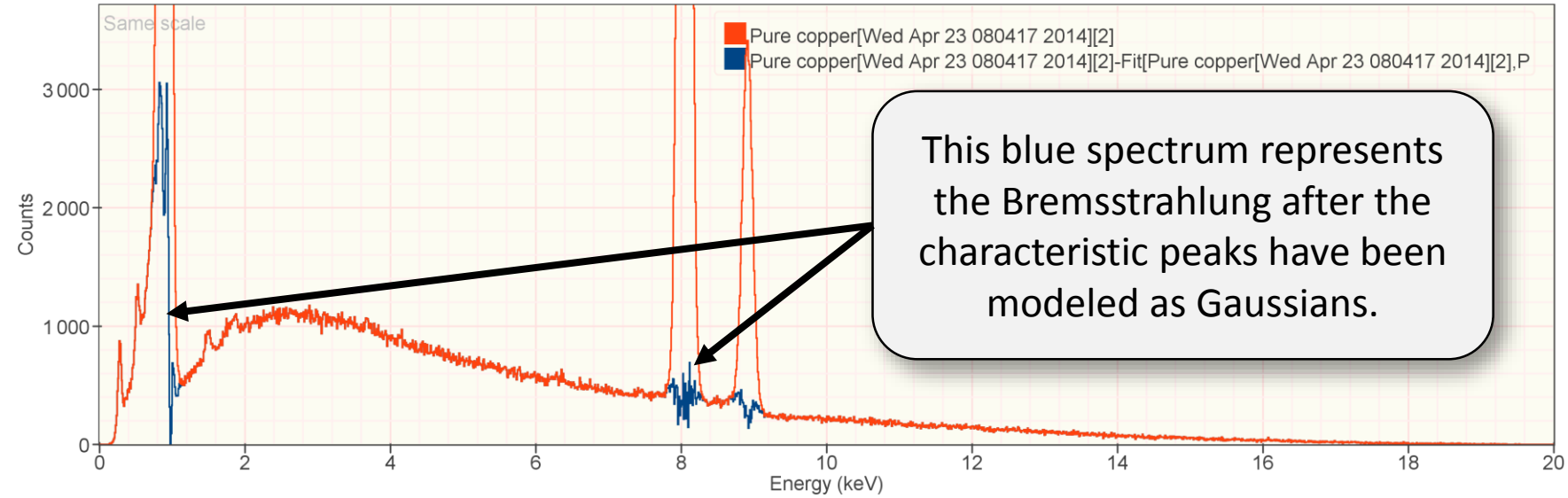

NIST DTSA-II
File Process Tools Report Help
950 × 301
Counts
Quality control alien
Previous: Welcome
Select a QC project
Next: Select a measured spectrum
EDS detector
Detector 2
QC Project
Pure copper at 20.0 keV on Detector 2
Material
Pure copper
Beam energy
20.0
keV
Nominal working distance
17.0
mm
Nominal probe current
1.0
nA
Use probe current normalization
Message:
More...
Back
Next
Finish
Cancel
Spectrum
Report
Command
Mass Fraction
Atomic Fraction
Welcome to NIST DTSA-II - Halley 2014-04-04 revision
Each detector can have one or more QC Project.
Using probe current normalization is a good idea!
The QC Project defines the sample and conditions under which the spectra are collected.
You define your own QC Project based on your own QC protocol.


NIST DTSA-II
File Process Tools Report Help
You add data to a QC Project by collecting the appropriate spectrum and assigning it to the project.
Previous: Select a QC project
a measured spectrum
Next: Review the results
QC Spectrum
Spectrum
oper[Wed Apr 23 080417 2014][2]
Open
Probe current
0.715 nA
Properties
Live time
60.8 seconds
Acquired
Apr 23, 2014
The date is read from the spectrum file and should be verified.
Message:
More...
Back
Next
Finish
Cancel
Spectrum
Report
Command
Default Detector
MIRA3
Detector 2
Spectrum List
Clear All
Mass Fraction
Atomic Fraction
Welcome to NIST DTSA-II - Halley 2014-04-04 revision


A QC is performed and the results are summarize and compared with the average, the earliest 10 measurements and the last 10 measurements.
When you select “Finish”, the results are written to a database which can be used to generate comprehensive reports.
NIST DTSA-II
the results
Finish
QC
Value
Average(All)
Avg(First 10)
Avg(Last 10)
Brem Counts
Channel width
Cu Kα
Cu Kβ
Cu L-family
Dose
Duane-Hunt
FWHM @ M...
Fano Factor
Noise
Total counts
Zero offset
Message:
More...
Back
Next
Finish
Cancel
Spectrum
Report
Command
Default Detector
MIRA3
Detector 2
Spectrum List
Pure copper[Wed Apr 23 080417 2014][2]
Pure copper[Wed Apr 23 080417 2014][2]
Fit[Pure copper[Wed Apr 23 080417 2014
Detector type
Silicon Drift Detector
Moxtek AP 3.3 (manufacturer's table)
35°
0.00000000 eV/ch^2
2.7 eV
10 eV/channel
Pure copper[Wed Apr 23 080417 2014][2...
MIRA3
Mass Fraction
Atomic Fraction
Clear All
The QC spectrum and the fits are added to the Spectrum List.
3 spectra selected

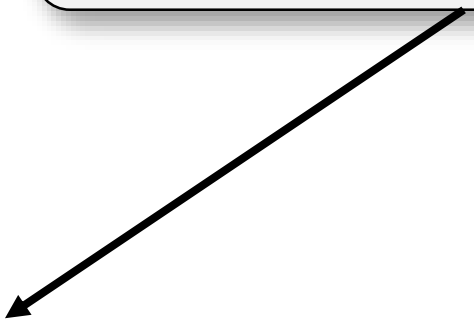


The fit spectrum should look practically indistinguishable from the measured. The fit is only performed near the characteristic peaks.



This blue spectrum represents the Bremsstrahlung after the characteristic peaks have been modeled as Gaussians.

A summary of the results is added to the daily Report.



QC Measurement Recorded

Spectrum	Pure copper[Wed Apr 23 080417 2014][2]
Index	357
Timestamp	2014-04-23 08:04:00.172
Project	Pure copper at 20.0 keV on Detector 2

Name	Value	First 10	Last 10	All
Brem Counts	17616.607	15162.162±379.378	17191.610±308.112	17248.179±8509.634
Channel width	9.9991±0.0002	9.9977±0.0115	9.9958±0.0061	9.9998±0.0193
Cu Kα	8783.620±14.224	7501.397±135.078	8521.800±144.388	8248.026±4017.949
Cu Kβ	1228.574±5.320	1022.609±18.033	1186.614±24.227	1144.741±558.908
Cu L-family	19161.918±21.008	16329.023±684.818	18544.781±296.238	18261.616±9043.992
Dose	43.416	58.579±3.462	43.204±24.191	32.860±18.005
Duane-Hunt	19.8988	19.9247±0.0395	19.9065±0.1277	19.8649±0.1140
FWHM @ Mn Ka	132.476±0.040	131.836±0.287	132.119±0.340	132.726±3.097
Fano Factor	0.120	0.117±0.001	0.120	0.120±0.001
Noise	6.664±0.011	6.800±0.023	6.566±0.093	6.696±0.743
Total counts	2031524.000	2344753.900±164191.258	1958076.100±1081892.462	1372116.534±792048.818
Zero offset	0.747±0.048	2.488±0.204	0.788±0.142	1.403±2.720

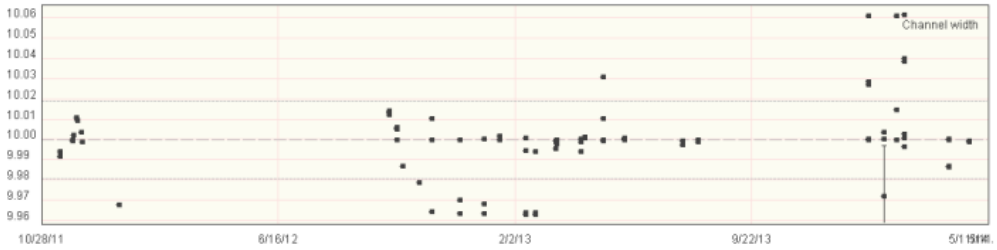
You can also generate a more comprehensive QC report with control charts.

Quality Control Report - Apr 23, 2014

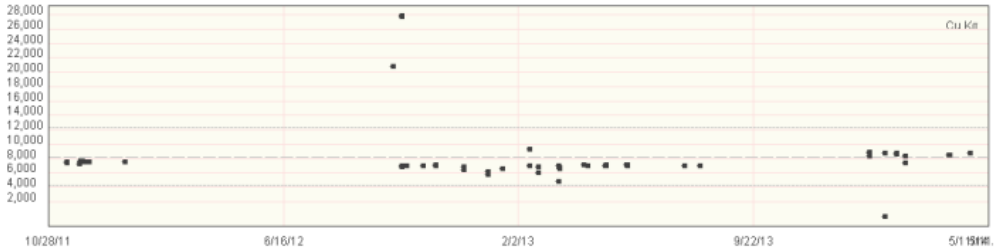
NIST DTSA-II Version	Halley 2014-04-04
EPQ Version	Halley 2014-04-04
Operator	Tescan

Item	Value
Detector	Detector 2 - FWHM[Mn Kα]=128.0 eV - initial
Beam Energy	20.0 keV
Material	Pure copper

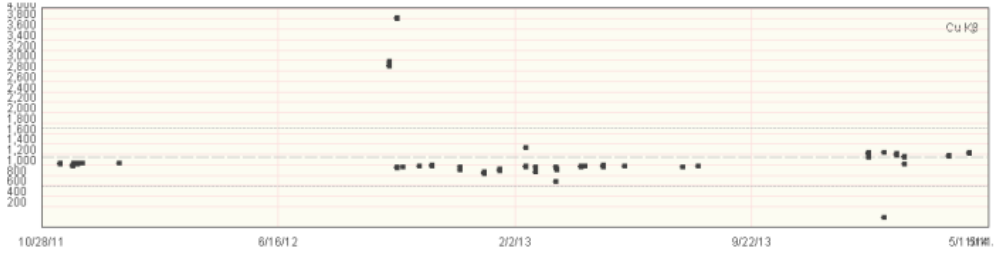
Channel width



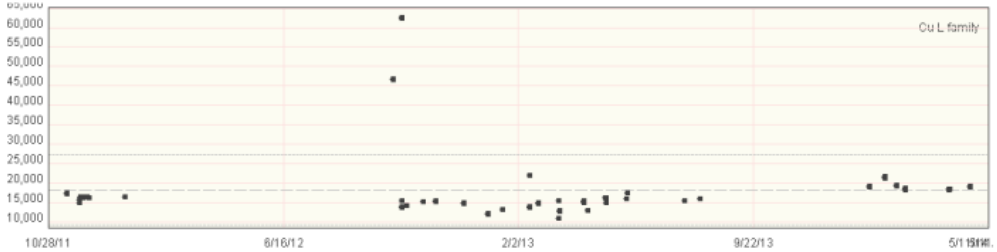
Cu Kα

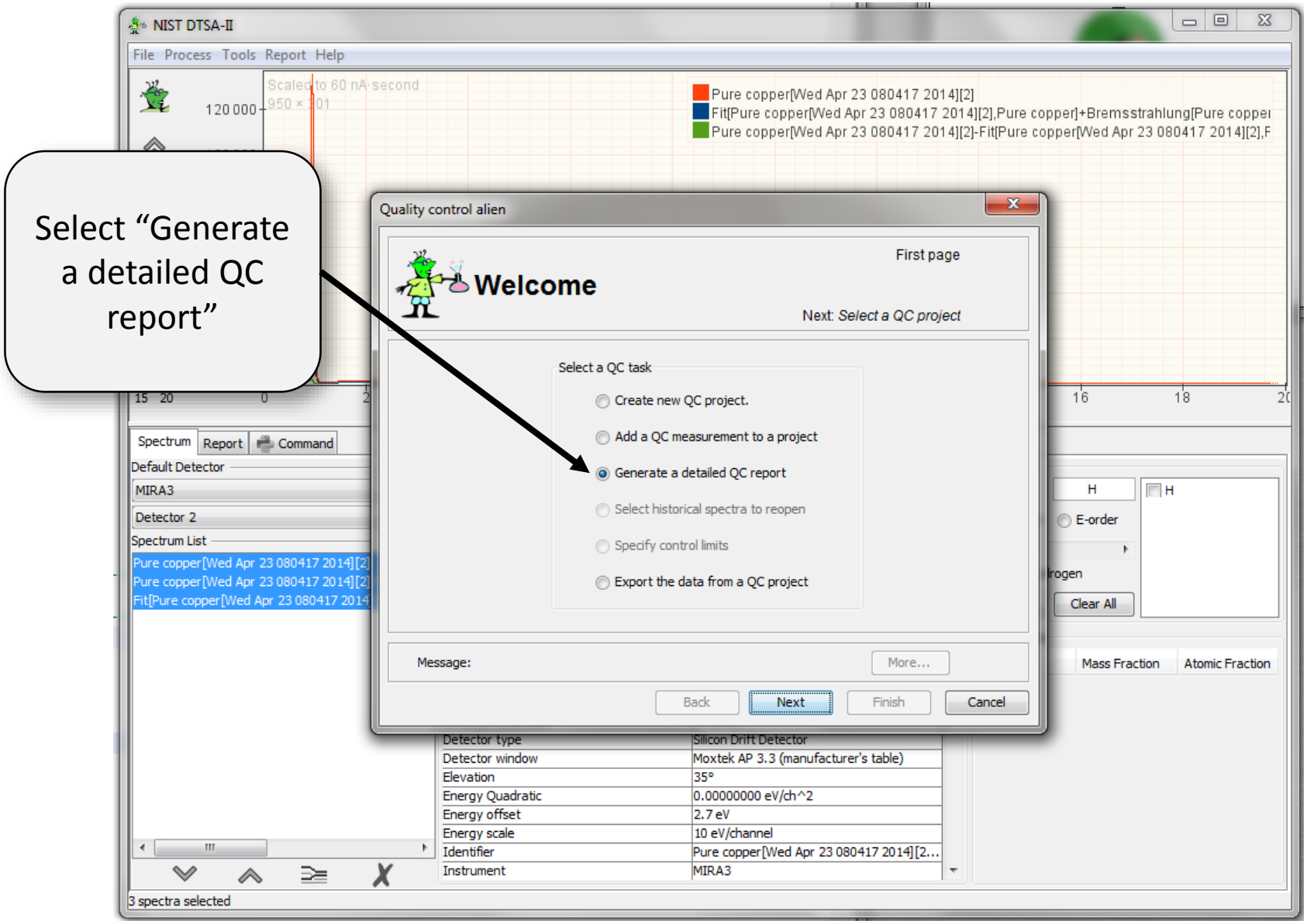


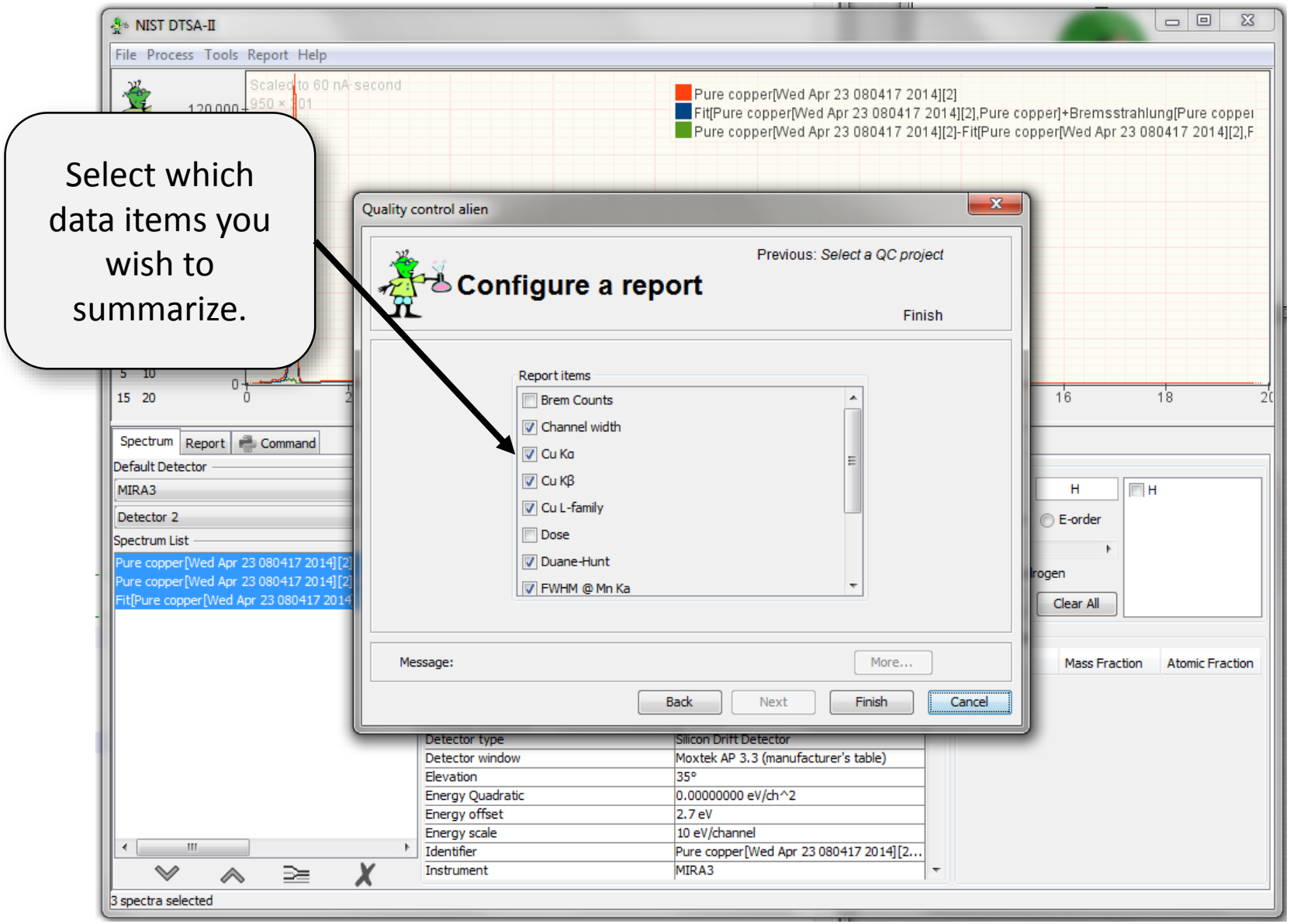
Cu Kβ



Cu L-family







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